

DEPARTMENT OF ENERGY	LESSON PLAN
	Course: Radiological Control Technician Unit: Site Academics Lesson: 2.08 Radiological Source Control
<p>Learning Objectives:</p> <p>2.08.01 Describe the requirements for radioactive sources as outlined in the DOE Radiological Controls Manual.</p> <p>☞ 2.08.02 Identify the radioactive sources that must be controlled at your site.</p> <p>☞ 2.08.03 Identify the packaging, marking, and labeling requirements for radioactive sources.</p> <p>☞ 2.08.04 Describe the approval and posting requirements for radioactive materials storage areas.</p> <p>☞ 2.08.05 Describe the procedures used at your site for storage and accountability of radioactive sources.</p>	
<p>References:</p> <ol style="list-style-type: none"> 1. DOE N 5400.6 (June 1992) "U.S. Department of Energy Radiological Control Manual" 2. DOE Order 5480.11 (1989) "Radiation Protection for Occupational Workers" 3. Implementation Guide for Occupational Radiation Protection: Sealed Radioactive Source Accountability and Control; G-N 5400.9/M1 - Rev. 1 November 1994 	
<p>Instructional Aides:</p> <p>Overhead projector and screen, chalkboard/whiteboard</p>	

I. LESSON INTRODUCTION**A. Self Introduction**

1. Name
2. Phone Number
3. Background

B. Motivation

Radioactive sources are used for; response checks in the field, functional checks, calibration of instruments and monitors to traceable standards, radiographic sources, soil compaction testing, and moisture/density gauges. To ensure the safety and welfare of all personnel it is important to maintain control of radioactive sources. The purpose of controlling radioactive sources is to minimize the potential for:

- Spread of contamination
- Unnecessary exposure to personnel
- Loss or theft
- Improper disposal

C. Overview of Lesson

1. Requirements
2. Control of sources
3. Receipt
4. Radioactive Materials Storage Areas
5. Inventory and transfer
6. Surveys
7. Leak test
8. Source disposal

D. Introduce Objectives

O.H.: Objectives

II. LESSON OUTLINE**A. DOE RADIOLOGICAL CONTROL MANUAL**

Objective 2.08.01

In accordance with the DOE RCM, the following provisions apply to sealed and unsealed sources:

1. G-N 5400.9/M1 describes how sealed sources shall be controlled and maintained, and specifies requirements for receipt, inventory, storage, transfer, disposal and integrity testing. Unsealed sources shall be controlled and maintained in a similar manner except for integrity testing.
2. Procurement of radioactive sources shall be coordinated with the Radiological Control Organization.
3. Receipt surveys of radiological material shipments shall be performed by the Radiological Control Organization.
4. Radioactive sources, including radiography sources, shall not be brought on-site by external organizations without the prior written approval of the Radiological Control Organization.

B. CONTROL OF SOURCES

Objective 2.08.02

(Insert site specific information here)

1. Types of Sources:
 - a. **Accountable Sealed Radioactive Source** - A sealed radioactive source with a half-life greater than or equal to 30 days and an activity greater than or equal to those listed in Appendix B of the IG.
 - b. **Exempted Radioactive Material** - Radioactive materials exempted from accountability under DOE Notice N 5400.9, but subject to the requirements of 10 CFR 835 and DOE Order 5480.11. Exempted radioactive materials include: materials in process, activated shielding materials, liquid and gaseous sources. Materials defined as consumer products (e.g., camera lenses, lantern mantles, smoke detectors, welding rods, etc.) are not subject to these requirements.
 - c. **Exempted Sealed Radioactive Source** - A sealed source having radioactive material with a half-life of less than 30 days or an activity less than the values for various radionuclides listed in Appendix B of the IG.

- d. **Sealed Radioactive Source** - Radioactive material that is contained in a sealed capsule, sealed between layers of nonradioactive material, or firmly fixed to a nonradioactive surface by electroplating or other means. The confining barrier prevents dispersion of the radioactive material under normal and most accidental conditions related to use of the radioactive source.
2. Responsibilities:
 - a. The Radiological Control Organization shall maintain or delegate the responsibility for:
 - 1) establishing the program (N 5400.9 (6.a))
 - 2) maintaining records related to the accountability and control of accountable sealed radioactive sources for a facility (N5400.9 (7.a.1&2))
 - 3) providing each source custodian with an inventory list of accountable sealed radioactive sources assigned to him or her (N5400.9 (7.a.1))
 - 4) assisting the source custodian in training source users (N5400.9 (7.a.1))
 - b. The source custodian:
 - 1) shall be responsible for ensuring that tests to establish the integrity of an accountable sealed radioactive source are conducted (N5400.9 (7.b)) and inventory checks are performed at least every 6 months (N 5400.9 (7.b)).
 - 2) should maintain records of the storage and use locations of all assigned accountable sealed radioactive sources (N 5400.9 (7.a.2)).
 - 3) shall be trained as a radiological worker prior to being designated as a source custodian.
 - 4) shall notify and obtain approval of the RCO prior to:

- a) any major changes in the use of a sealed radioactive source
 - b) on-site transfer of a sealed radioactive source to a new permanent storage location
 - c) modification of a device containing a sealed radioactive source
 - d) disposal or off-site transfer of a sealed radioactive source
 - e) any procurement or acquisition of additional sealed radioactive sources
- 5) should also notify the RCO in the event of the loss or damage to any accountable sealed radioactive source
- c. The source user:
- 1) should be an individual trained by the RCO and the source custodian to use either accountable or exempt sealed radioactive sources
 - 2) should be trained as a radiological worker and receive appropriate training on handling their specific sealed radioactive source(s).

C. RECEIPT

Prior to receipt of accountable sealed radioactive sources, the RCO should assign the sources to the proper source custodians. Immediately upon receipt of accountable sealed radioactive sources, the RCO should be notified. The packaging should be inspected for damage and a contamination and radiation survey performed. The RCO shall perform receipt surveys (RCM 431.3). A source integrity test shall be performed upon receipt if visible damage to the package exists (N 5400.9 (7.d)), or prior to initial use. The source custodian should be notified of the arrival of the sealed sources to ensure that proper accountability and control are initiated. The sources should be placed into storage or into the device in which they will be used. The source custodian and site's records should be updated to include the new sources received.

D. LABELING AND STORAGE OF RADIOACTIVE SOURCES

Objective: 2.08.03

(Insert site specific information here)

1. Radioactive items or containers of radioactive materials **shall** be individually labeled if adequate warning is not provided by control measures and posting (10 CFR 835.601 (a) and RCM 412.1).
2. All sealed (accountable and exempt) radioactive sources or their associated storage containers shall be clearly marked as radioactive material with the words "CAUTION, RADIOACTIVE MATERIAL" or the standard radiation symbol (N 5400.9 (7.c.1) and RCM 412). Labels shall have a yellow background with a magenta or black standard radiation symbol. Lettering shall be magenta or black (RCM 412.3). Storage containers and devices containing a radioactive sources shall have a durable label/tag that contains the following information (N 5400.9 (7.c.1)):
 - a. Major radionuclide
 - b. Amount of radioactivity (curie content)
 - c. Date of assay
 - d. Model and serial number
 - e. Source Custodian's name and site telephone extension
3. In addition, labels should include the contact radiation levels, removable contamination levels, dates surveyed, and surveyor's name (RCM 412.4). The label should be sufficiently durable to remain legible for the useful life of the device or storage container and should be located in a readily visible place.
4. Accountable sealed sources not in storage containers or devices and not labeled by the manufacturer should be labeled with the following information (N 5400.9 (7.c.2)):
 - a. the words "CAUTION, RADIOACTIVE MATERIAL" or the standard radiation symbol

- b. radionuclide name
 - c. amount of activity
 - d. date of assay
 - e. name of manufacturer
 - f. model name and serial number
5. If the radioactive source is an integral part of a larger piece of equipment, the equipment may be labeled in lieu of the radioactive source itself. Extremely small radioactive sources need a permanent tag attached or be stored in a larger container to prevent the loss of the radioactive source and to allow space for the required markings/identification.

E. RADIOACTIVE MATERIALS STORAGE AREAS Objective: 2.08.04

(Insert site specific information here)

Storage rooms or cabinets containing radioactive sources shall meet all the following requirements:

1. Locked and posted
2. Located to minimize damage from fire
3. Free of flammable substances
4. Isolated from occupied areas or located in radiological areas or radiological buffer areas
5. When selected in continuously occupied controlled areas, the radiation level at the closest approach is as low as reasonably achievable and does not exceed 0.5 millirem per hour on average
6. All radioactive sources with activities greater than the levels posted in DOE 5400.9 must be kept under lock when not in use

F. INVENTORY AND TRANSFER Objective: 2.08.05

(Insert site specific information here)

1. All accountable sealed radioactive sources shall be physically checked and their locations verified every six months (N 5400.9 (7.b)). Exempted radioactive material and exempted sealed radioactive sources are not required to be inventoried. Upon determination that an accountable sealed radioactive source has been lost, the RCO should be notified.
2. An inventory system should provide for tracking accountable sealed radioactive sources. As a minimum, records for accountable sources for a facility shall be organized into a single, comprehensive filing system (N 5400.9 (7.a.2)). The system shall maintain both original and updated information related to accountable sealed radioactive sources (N 5400.9 (7.a.2)), including:
 - a. Major radionuclide
 - b. Curie content or disintegration rate
 - c. Physical and chemical description of the radioactive source
 - d. Manufacturer
 - e. Date of receipt
 - f. Date of assay
 - g. Radioactive source model and serial number (and device containing the radioactive source)
 - h. Inventory check dates
 - i. Transfers
3. All permanent transfers and disposal(s) of accountable and exempt radioactive sources shall be recorded in the radioactive source logbook by the source user or custodian.

G. SURVEYS

1. Immediately upon receipt of accountable sealed radioactive sources, the RCO should be notified. The packaging should be inspected for damage and a contamination and radiation survey performed. The RCO shall perform receipt surveys (RCM 431.3). A source integrity test shall be performed upon receipt if visible damage to the package exists (N 5400.9 (7.d)), or prior to initial use.
2. Storage rooms or cabinets containing either accountable or exempt quantity sealed radioactive sources shall be locked, surveyed routinely, and posted in accordance with N 5400.9 (7.c.1).
3. Radiation and contamination surveys of sealed radioactive source storage areas or facilities should be performed before its initial use and at least every six months thereafter. Surveys **shall** be performed whenever changes in status are made that may significantly affect radiological conditions (10 CFR 835.401(a)(3), 5480.11, RCM 551.7)

H. LEAK TEST (INTEGRITY TEST)

1. A test of source integrity shall be made at least every 6 months or whenever damage might have occurred. The integrity of a sealed source is established by a wipe test and leak test procedures. A wipe test is made on the surrounding surface(s) of the source, except for the active areas. A source contained in a shield or device is checked by wiping the area of the shield or device, where contamination is most likely to occur from a failure of the source integrity. The leak test must be capable of verifying the removable activity is less than 5 nanocuries (nCi) per 100 cm². If the activity of the wipe indicates the presence of 5 nCi/100 cm² or more of removable contamination, the source will be considered breached and must be removed from service and treated as a nonsealed source.
2. An integrity test should also be performed when any measurable contamination is detected on handling or storage equipment(unless the contamination is known to be from another source).

3. An integrity test is not required if the sealed source contains a radionuclide with a half-life of less than 30 days, liquid, or gaseous radionuclide(s), or a radionuclide with an activity smaller than the value listed in Appendix B of the IG. Sealed gaseous radionuclides are exempted from integrity testing because the rapidity with which the gas escapes and diffuses into the air renders the test of little value. Gaseous and liquid sealed radioactive sources should be treated as radioactive materials.

I. SOURCE DISPOSAL

Obsolete, excess, or leaking accountable sealed radioactive sources should be disposed of according to RCO instructions.

III. SUMMARY

- A. Review major points
 1. Requirements
 2. Control of sources
 3. Receipt
 4. Radioactive Materials Storage Areas
 5. Inventory and transfer
 6. Surveys
 7. Leak test
 8. Source disposal
- B. Review learning objectives

IV. EVALUATION

Evaluation shall consist of a written examination comprised of multiple choice, fill-in the blank, matching and/or short answer questions. 80% shall be the minimum passing criteria for examinations.